FIG. 1

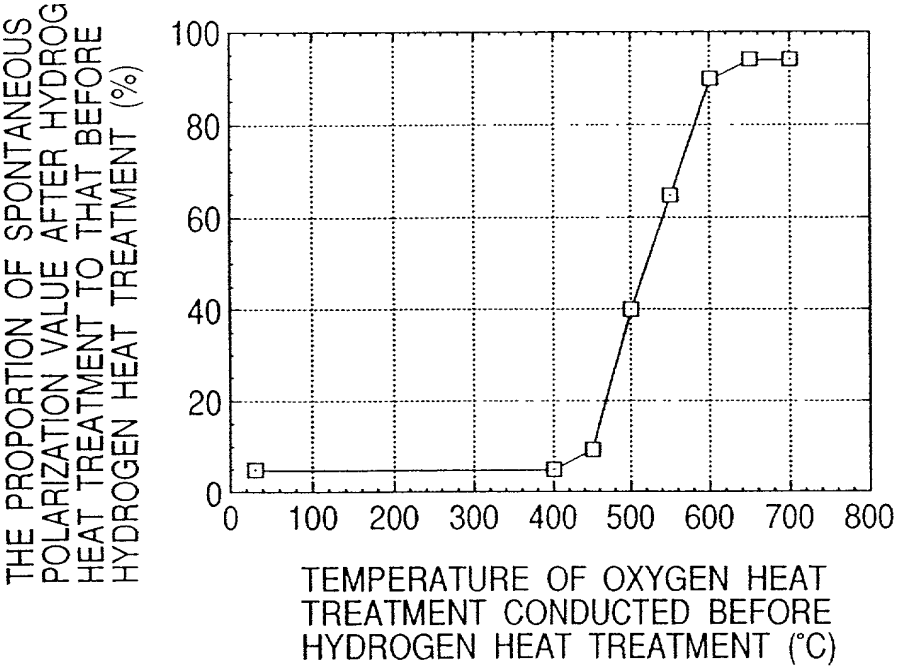

THE PROPORTION OF SPONTANEOUS POLARIZATION VALUE AFTER HYDROGEN HEAT TREATMENT TO THAT BEFORE HYDROGEN HEAT TREATMENT (%)
100
80
60
40
20
0
0
100
200
300
400
500
600
700
800
TEMPERATURE OF OXYGEN HEAT TREATMENT CONDUCTED BEFORE HYDROGEN HEAT TREATMENT (°C)

FIG. 2

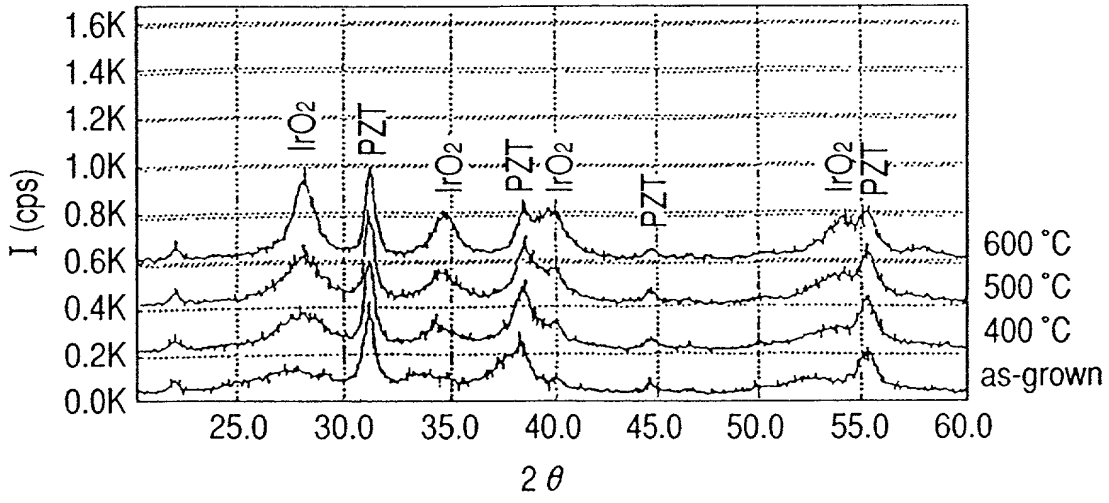

I (cps)
1.6K
1.4K
1.2K
1.0K
0.8K
0.6K
0.4K
0.2K
0.0K
IrO2
PZT
IrO2
PZT
IrO2
PZT
IrO2
PZT
600 °C
500 °C
400 °C
as-grown
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
2θ

FIG. 3

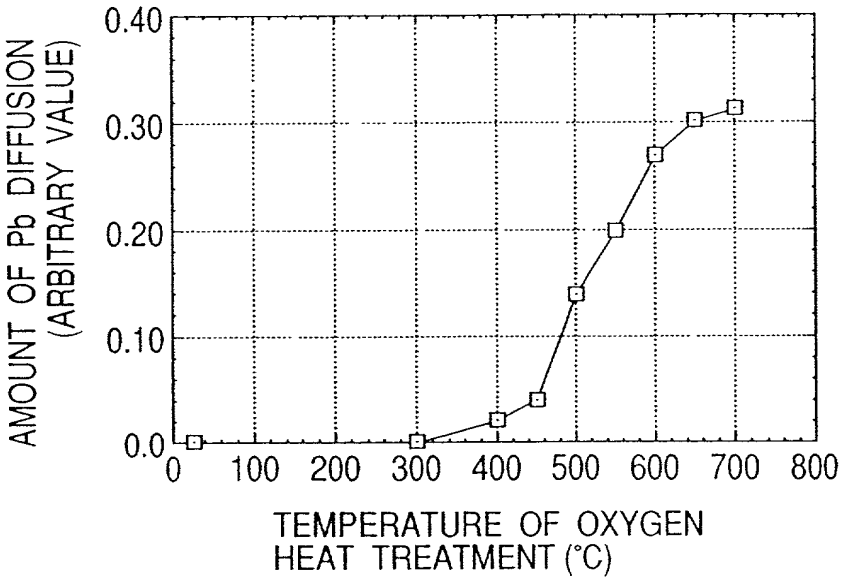

AMOUNT OF Pb DIFFUSION
(ARBITRARY VALUE)
0.40
0.30
0.20
0.10
0.0
0
100
200
300
400
500
600
700
800
TEMPERATURE OF OXYGEN
HEAT TREATMENT (°C)

FIG. 4

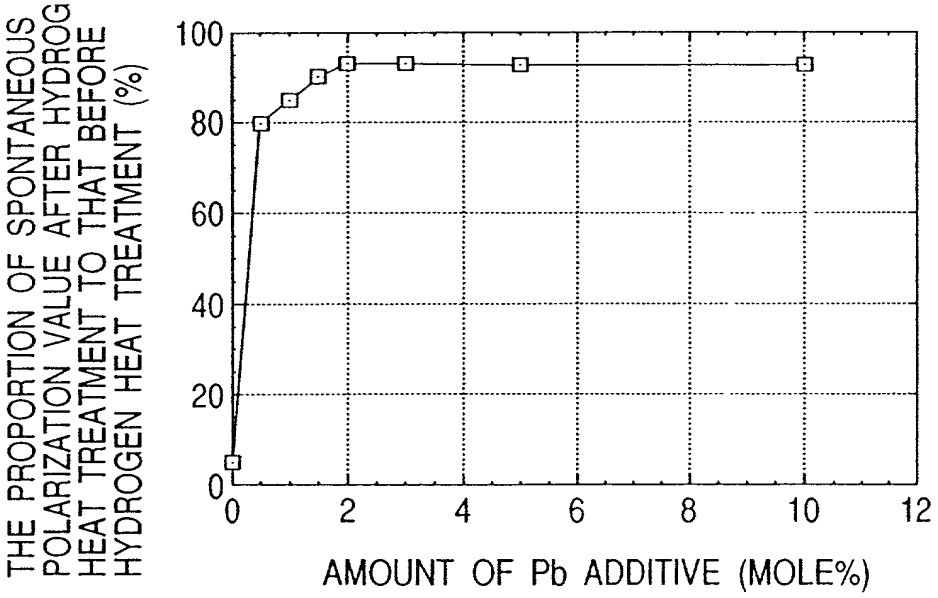

THE PROPORTION OF SPONTANEOUS
POLARIZATION VALUE AFTER HYDROGEN
HEAT TREATMENT TO THAT BEFORE
HYDROGEN HEAT TREATMENT (%)
100
80
60
40
20
0
0
2
4
6
8
10
12
AMOUNT OF Pb ADDITIVE (MOLE%)

FIG. 5

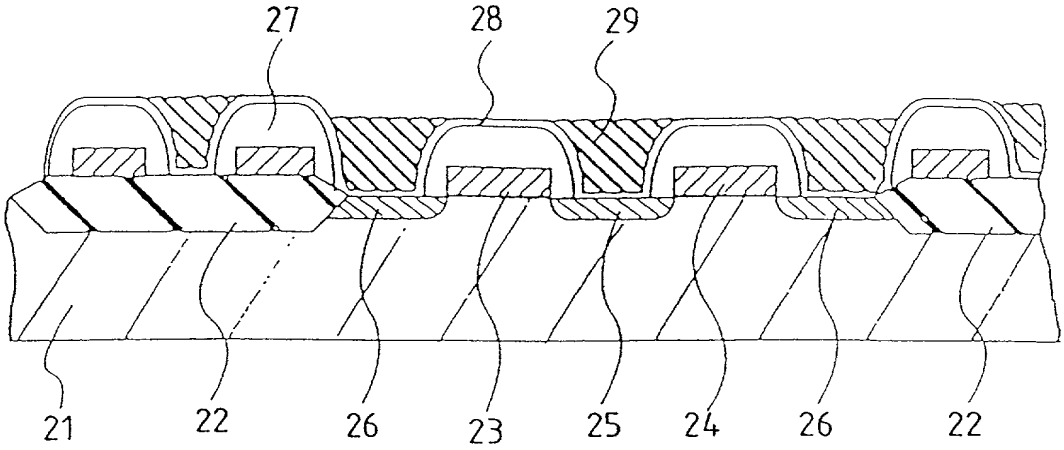

27
28
29
21
22
26
23
25
24
26
22

FIG. 6

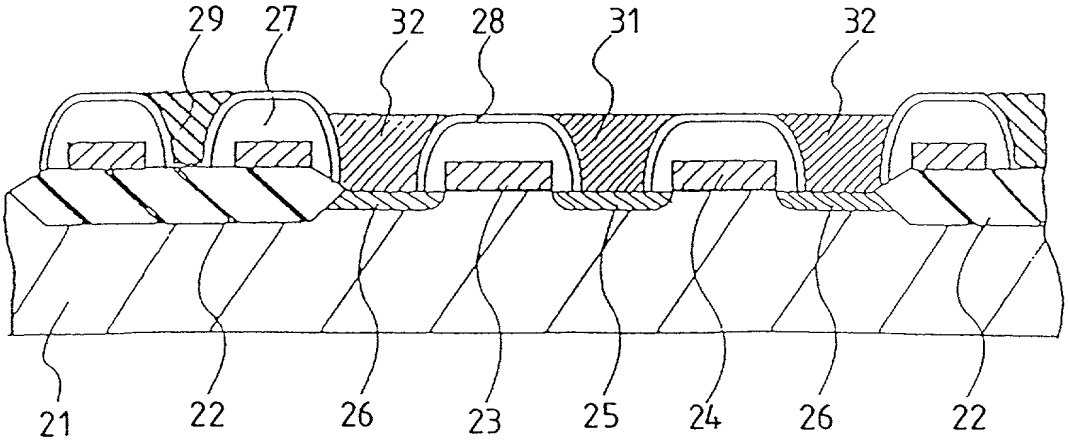

29
27
32
28
31
32
21
22
26
23
25
24
26
22

FIG. 7

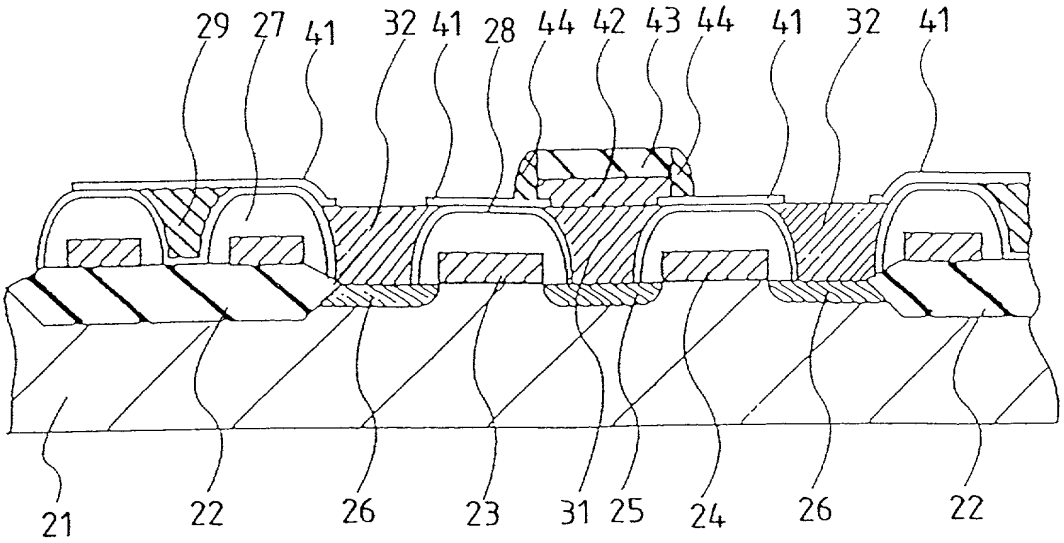

29
27
41
32
41
28
44
42
43
44
41
32
41
21
22
26
23
31
25
24
26
22

FIG. 8

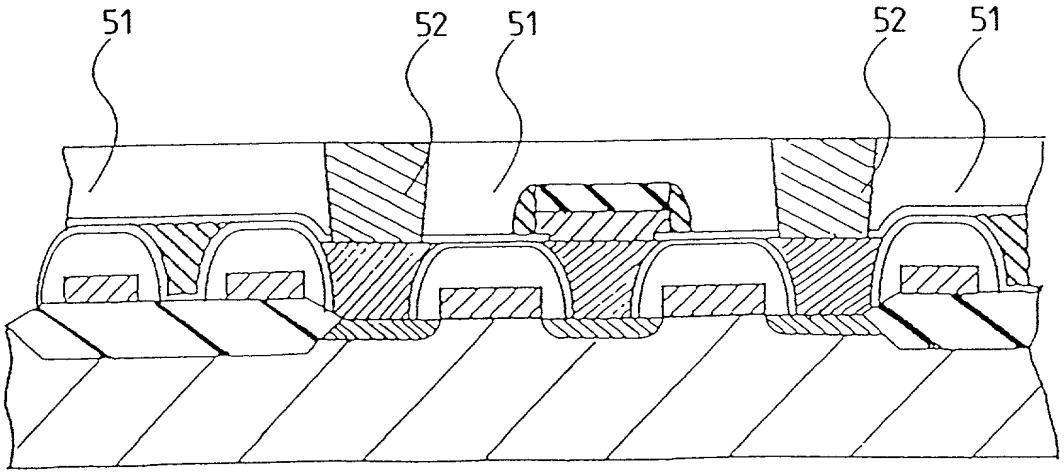

51
52
51
52
51

FIG. 9

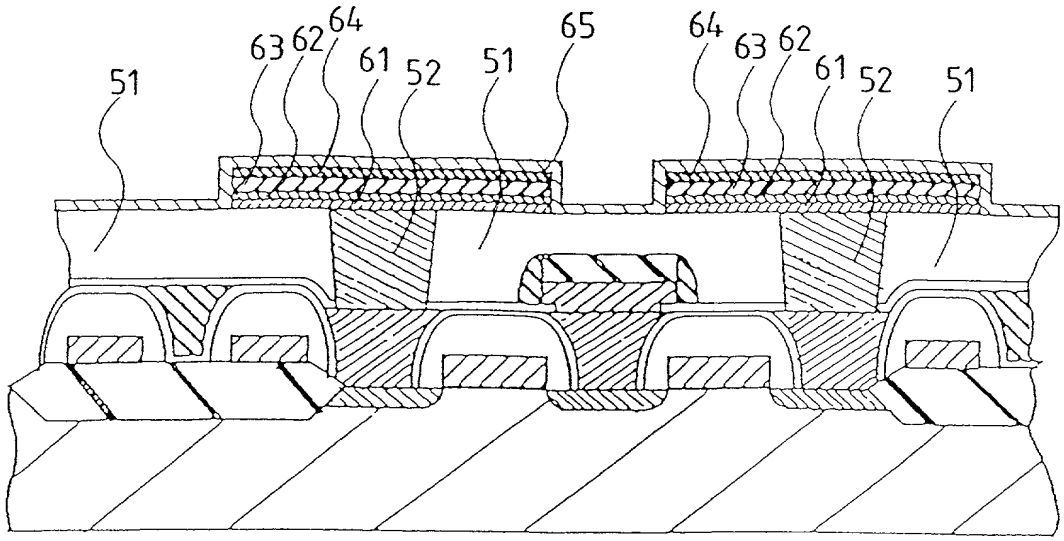

51
63
62
64
61
52
51
65
64
63
62
61
52
51

FIG. 10

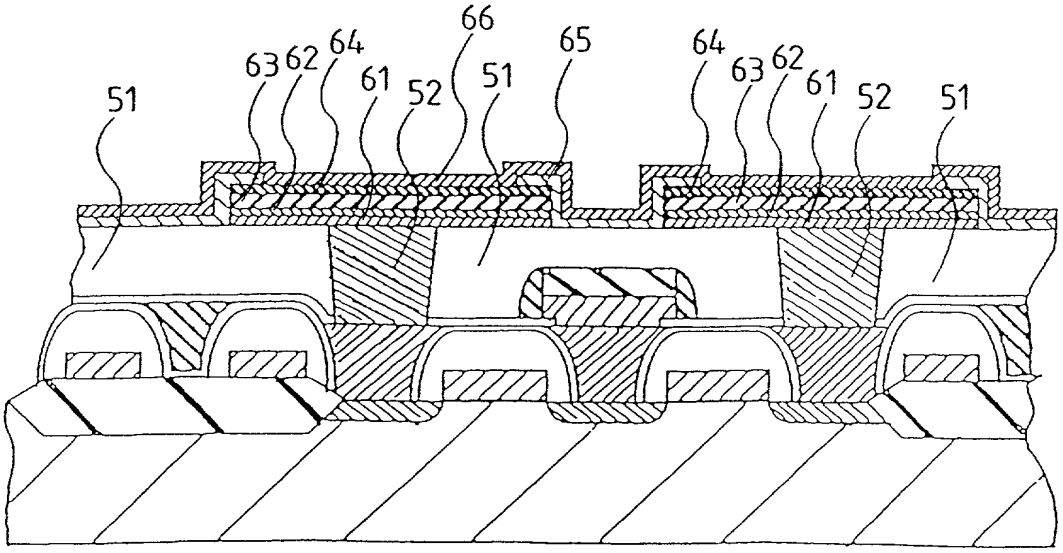

51
63
62
64
61
52
66
51
65
64
63
62
61
52
51

FIG. 11

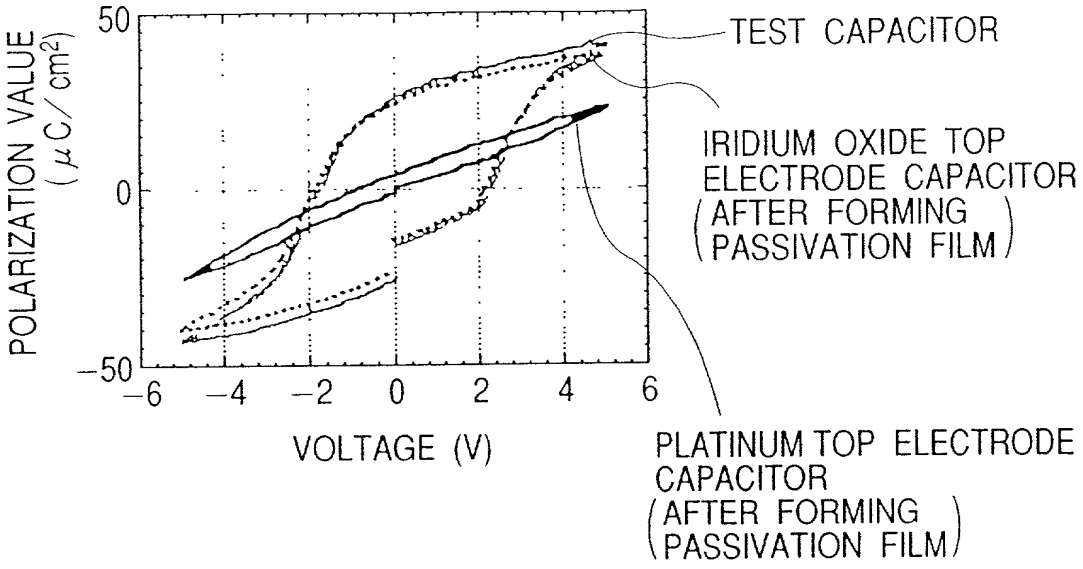

POLARIZATION VALUE (μC/cm²)
50
0
−50
−6
−4
−2
0
2
4
6
VOLTAGE (V)
TEST CAPACITOR
IRIDIUM OXIDE TOP ELECTRODE CAPACITOR (AFTER FORMING PASSIVATION FILM)
PLATINUM TOP ELECTRODE CAPACITOR (AFTER FORMING PASSIVATION FILM)

FIG. 12

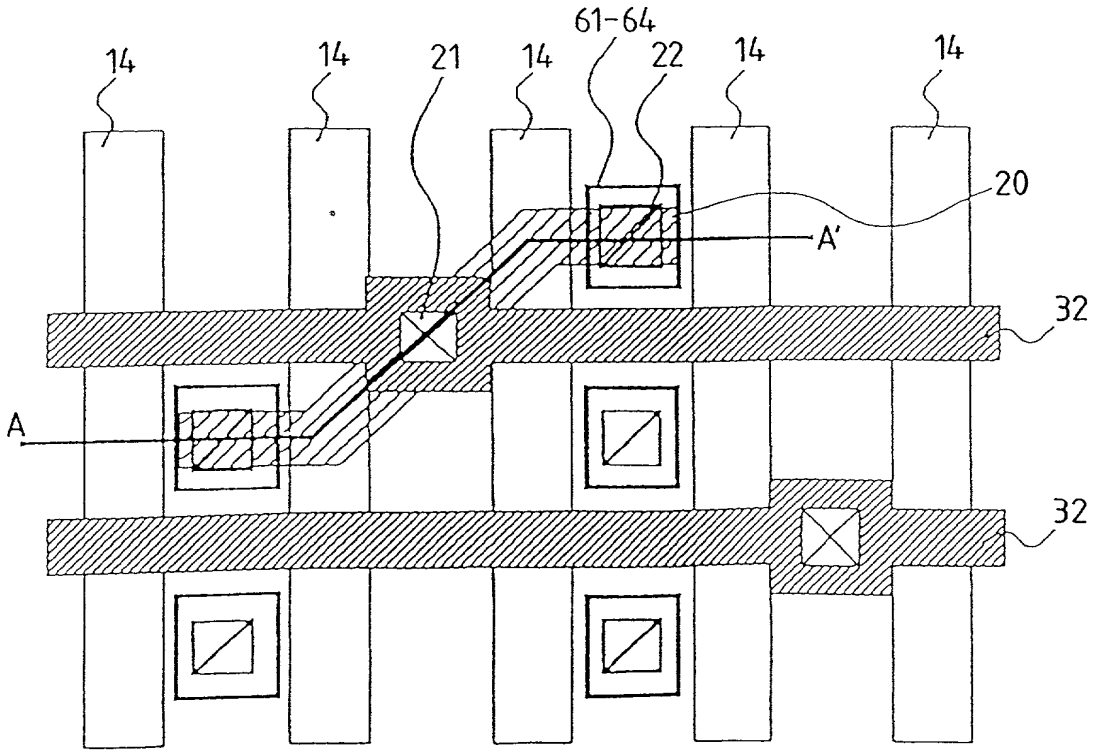

61-64
14
14
21
14
22
14
14
20
A'
32
A
32

FIG. 13

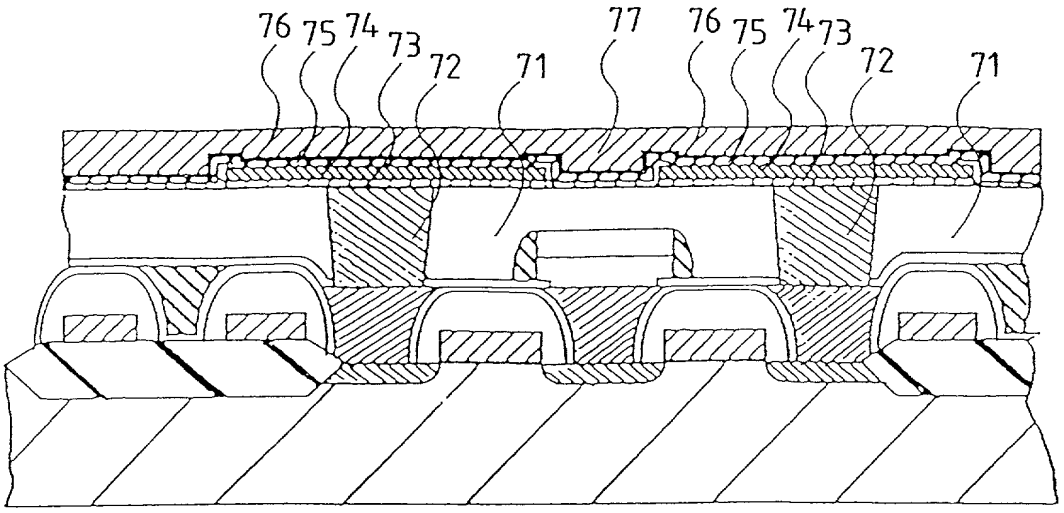
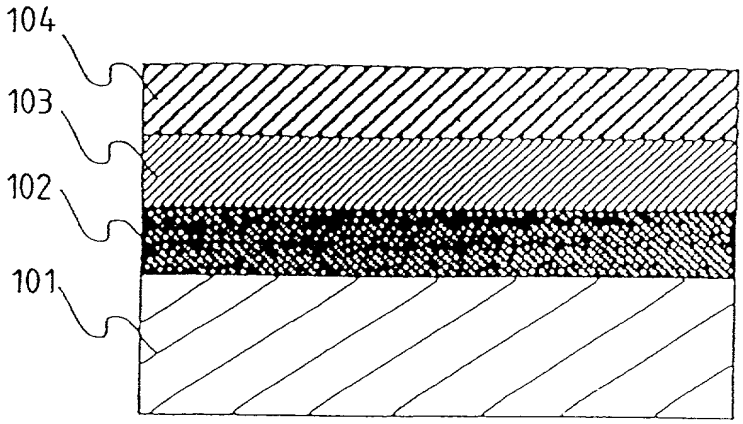


FIG. 14



104: PLATINUM LAYER WITH Pb ADDITIVE (TOP ELECTRODE)

103: FERROELECTRIC THIN FILM

102: BOTTON ELECTRODE

101: DEVICE LAYER INCLUDING TRANSISTORS (OR METAL SUPPORT)

FIG. 15

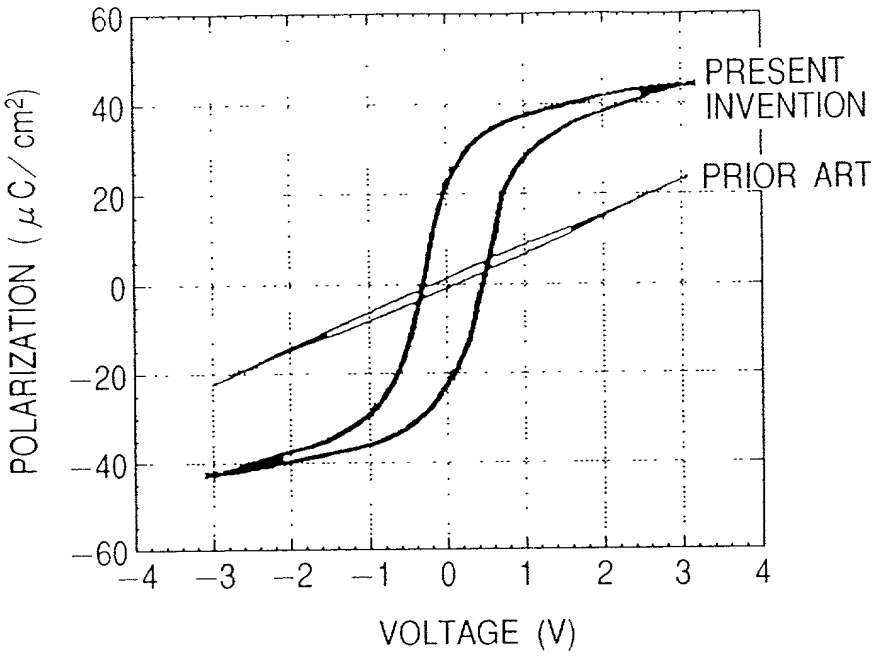

60
40
20
0
−20
−40
−60
−4
−3
−2
−1
0
1
2
3
4
POLARIZATION (μC/cm²)
VOLTAGE (V)
PRESENT INVENTION
PRIOR ART

FIG. 16

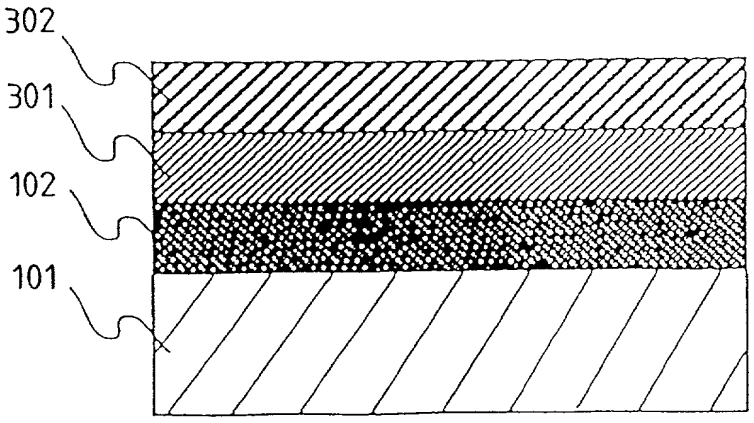

302
301
102
101

FIG. 17

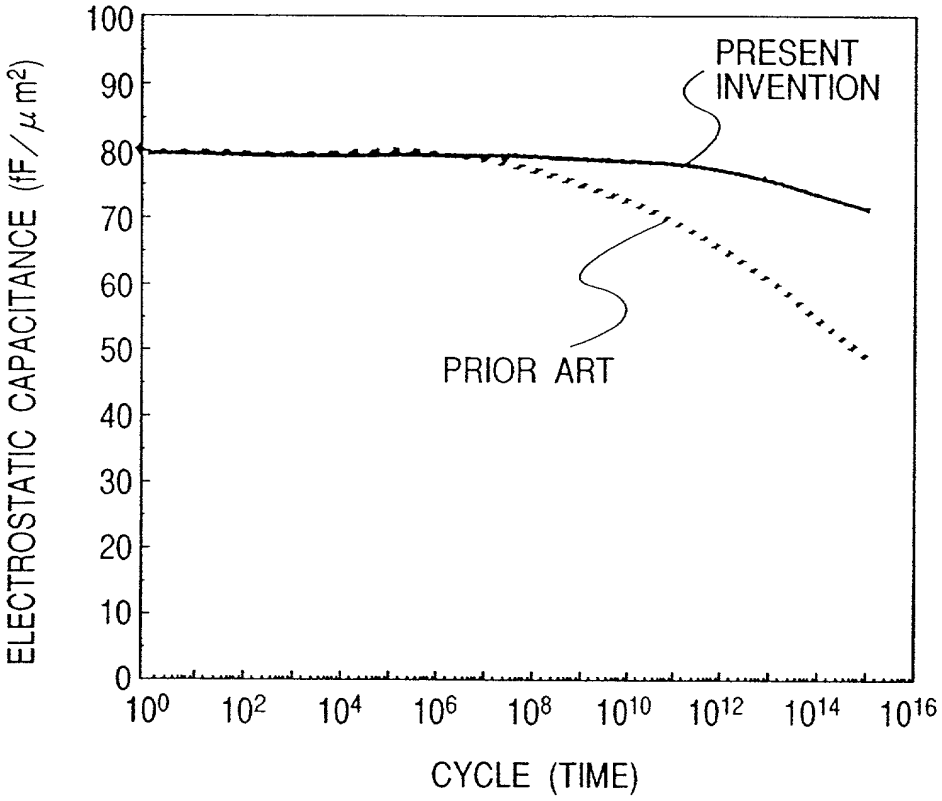

ELECTROSTATIC CAPACITANCE (fF/μm²)
100
90
80
70
60
50
40
30
20
10
0
PRESENT INVENTION
PRIOR ART
10⁰
10²
10⁴
10⁶
10⁸
10¹⁰
10¹²
10¹⁴
10¹⁶
CYCLE (TIME)

FIG. 18

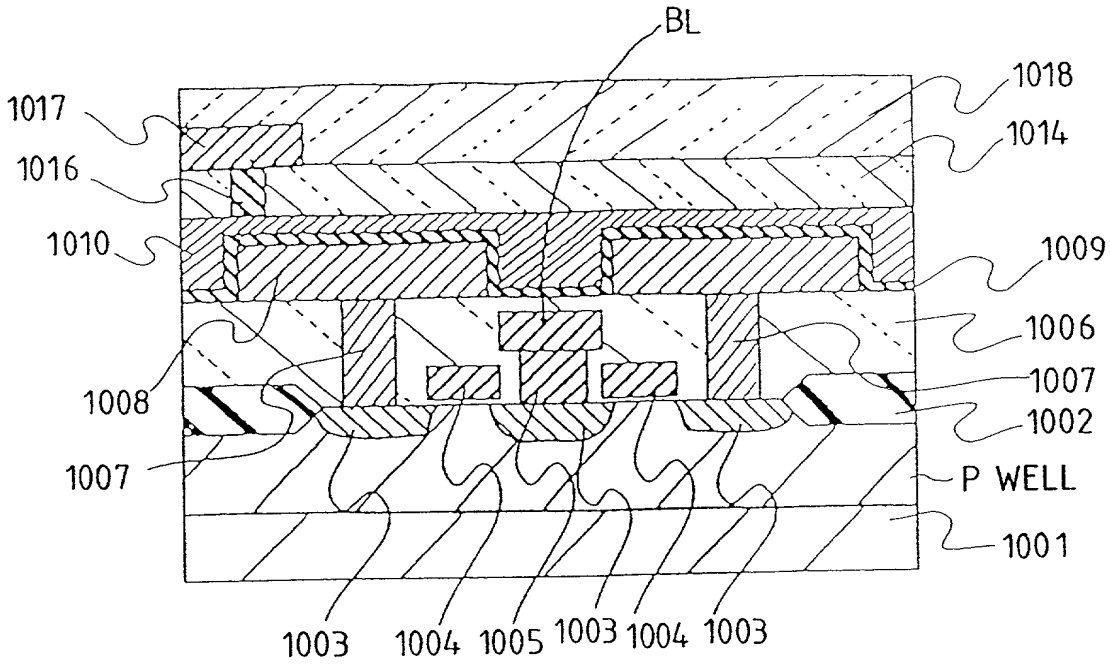

BL
1018
1017
1014
1016
1010
1009
1006
1008
1007
1002
1007
P WELL
1001
1003
1004
1005
1003
1004
1003

FIG. 19

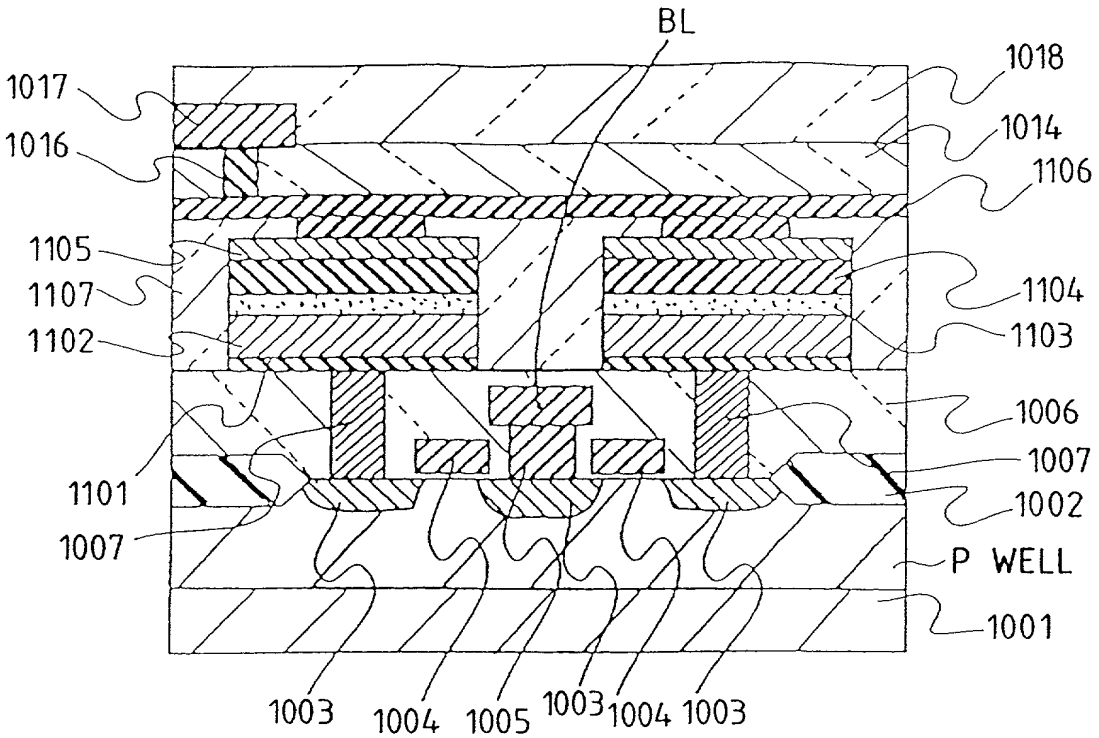
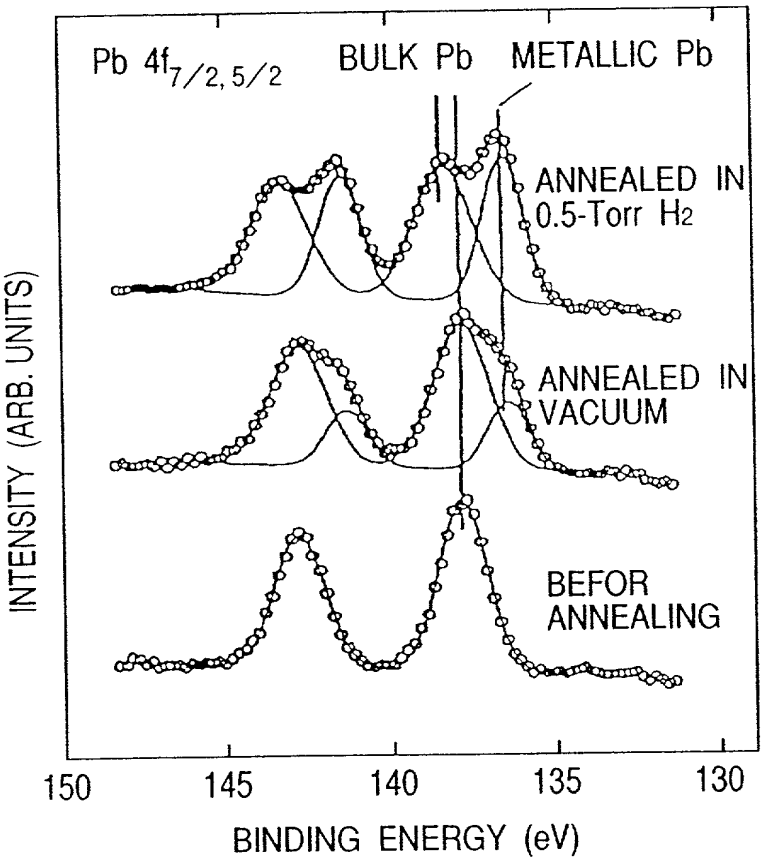

BL
1018
1017
1014
1016
1106
1105
1104
1107
1103
1102
1006
1007
1101
1002
1007
P WELL
1001
1003
1004
1005
1003
1004
1003

FIG. 20


Pb 4f7/2,5/2
BULK Pb
METALLIC Pb
ANNEALED IN 0.5-Torr H2
ANNEALED IN VACUUM
BEFOR ANNEALING
INTENSITY (ARB. UNITS)
150
145
140
135
130
BINDING ENERGY (eV)